APPENDIX B

Emissions Reduction and Cost Effectiveness Analysis for Rule 4550 (Conservation Management Practices)

April 15, 2004

Preliminary Emissions Reduction and Cost Effectiveness Analysis for Rule 4550 Conservation Management Practices

March 12, 2004

1. INTRODUCTION AND SUMMARY

District staff has performed a preliminary PM10 emissions reduction analysis and a preliminary cost effectiveness analysis for the proposed provisions of Rule 4550 (Conservation Management Practices) as required by the California Health and Safety Code.

The proposed requirements of Rule 4550 would specify that the growers and Animal Feeding Operation (AFO) producers select one Conservation Management Practice (CMP) for each of the identified applicable CMP categories for their operations and implement the CMPs. A CMP is a practice or activity that reduces air pollutants. The selected CMPs are to be listed on application forms which would constitute a CMP Plan. A CMP Plan will contain growers/producers contact information, agricultural operation site, maps, and the CMPs selected by the growers and producers. The CMP Plans will be approved by the District and will be subject to District enforcement. Some of the requirements of Rule 4550 will become effective upon adoption of the rule. The CMP Plans will become effective July 1, 2004; however, the CMP applications must be submitted no later than December 31, 2004.

The emissions reduction and the cost effectiveness for Rule 4550 are based on limited information available at this time. The estimated emissions reduction for Rule 4550 is 34.2 tons/day with an estimated range of cost effectiveness of $8 savings to $2,500 per ton of PM10 reduced. This preliminary analysis has been conducted for cropland, dairy, poultry, and feedlot source categories.

2. EMISSIONS REDUCTION ANALYSIS

A. Assumptions Used in Calculating Emissions Reduction

The following main assumptions were used in calculating the PM10 emissions reduction:

- Growers/AFO producers must select one (1) CMP for each of the applicable CMP categories. Note: There are five CMP categories for the cropland source categories, four CMP categories for the dairy source category, four CMP categories

for the feedlot source category, and five CMP categories for the poultry source category.

- With use of a 100-acre exemption threshold, 8.7% of cropland acreage is exempt from the rule. Note: The database used to estimate the acreage provides total farm acreage per farm size per county. Therefore, this percentage is based on the total acreage in the San Joaquin Valley.
- With use of a 500-head exemption threshold, 27% of dairy cattle are exempt from the rule. Note: The database used to estimate the number of head of cattle does not provide herd size per facility. Therefore, this percentage is based on total dairy cattle population in the San Joaquin Valley.
- With use of a 190-head exemption threshold, 6% of feedlot cattle are exempt from the rule. The database used to estimate the number of head of cattle does not provide individual herd size. Therefore, this percentage is based on total feedlot cattle population in the San Joaquin Valley.
- For the purpose of this analysis, the agricultural operation sites subject to Rule 4550 (affected sources) would achieve a 60% compliance rate for 2004 and an 80% compliance rate in 2005 and beyond.
- For some CMPs a minimum 10% control efficiency was assumed. PM10 reductions are based on limited data. The control efficiencies will be updated as research is completed.

B. Emission Reductions Calculations

In order to quantify the emission reductions achievable from Rule 4550, District staff identified major groups of PM10 emission sources as CMP Categories. Some examples are: land preparation; harvest; unpaved roads; unpaved equipment and traffic areas; other, which includes windblown dust and waste burning; corral/manure handling; overall management/feeding; and feeding.

Because it is not possible to identify which specific CMP that an owner/AFO producer would select for each CMP category, the CMPs most likely to be selected were assigned to each CMP category analyzed. The affected sources were also grouped into several commodity categories, for example, dairy AFO, feedlot AFO, poultry AFO, cotton, almonds, grapes, and vegetables.

Tables 1 and 2 provide examples for the calculation of emissions reduction for the CMP category “Harvesting” for the Source Category “Grapes” and the CMP Category “Corral/manure handling” for the Source Category “Dairy AFO”.

The following steps were performed for each CMP Category to calculate the emissions reduction.

- A control efficiency was determined for each CMP. It is labeled as "Control Efficiency" in the tables.
- The "Rule Participation Percentage" was applied. This participation is the percentage of affected sources that would be subject to Rule 4550. The rule participation percentage is estimated to be 91.3% for the croplands source category, 73% for the dairy AFO source category and 94% for the feedlot AFO source category.
- The "Compliance Factor" was applied. It is the percentage of affected sources in compliance with the rule at any given time. It was assumed that 60% will comply in the year 2004 and that 80% will comply in and after 2005.
- The emission inventories for agricultural sources was allocated to each CMP Category. The allocated PM10 emissions are labeled "PM10 Emissions" in the tables.
- The probability of each CMP to be implemented was determined. This is the "Estimated Percentage of CMP Usage."
- The information above was used in the following equation to estimate the emissions reduction per CMP:

  PM10 emissions reduction per CMP =

  Control efficiency x Rule Participation Percentage x Rule Compliance Factor x PM10 Emissions x Estimated Percentage of CMP usage

- The PM10 emissions reduction for all CMPs were summed to give the emissions reduction per CMP Category.

Finally, the emissions reduction per CMP category for all source categories were summed to provide the total estimated emissions reduction of 34.2 tons per day from the implementation of Rule 4550.

Table 1: Emissions Reduction
Source Category: Grapes
CMP Category: Harvest

CMP	Control Efficiency %	Rule Participation Percentage	Compliance Factor %	PM10 Emissions (tons/day)	Estimated % of CMP Usage	PM10 Emissions Reduction (tons/day)
	(CE)	**(RP)**	**(CF)**	**(EI)**	**%**	**(ER)= CE x RPx CF x EI x %**
Combined Operations	43	91	80	0.13	46	0.019
Continuous Tray/DOV	43	91	80	0.13	30	0.012
Equipment Changes/Technological Changes	50	91	80	0.13	16	0.008
Hand Harvest	100	91	80	0.13	3	0.003
Land Set-Aside	100	91	80	0.13	3	0.003
Night Harvest	10	91	80	0.13	3	0
Precision Farming/GPS	8	91	80	0.13	0	0
TOTAL						0.045

Note: The numbers presented in all the tables may not add to the total due to rounding.

Table 2: Emissions Reduction
Source Category: Dairy AFO
CMP Category: Corral/Manure Handling

CMP	Control Efficiency %	Rule Participation Percentage	Compliance Factor %	PM10 Emissions (tons/day)	Estimated % of CMP Usage	PM10 Emissions Reduction (tons/day)
	(CE)	**(RP)**	**(CF)**	**(EI)**	**%**	**(ER)= CE x RP x CF x EI x %**
Animal Housing	25	73	80	1.37	60	0.09
Manure Harvesting Equipment	10	73	80	1.37	10	0.01
Shade for Animal	10	73	80	1.37	20	0.01
Scraping in early morning when moisture is higher	10	73	80	1.37	10	0.00
TOTAL						0.11

The following table summarizes the base 1999 PM10 emission inventory and estimated emissions reduction for Rule 4550 in 2010:

Table 3: Estimated Rule 4550 Emissions Reduction in 2010

CMP Category	PM10 Emissions (tons/day)	Estimated Emissions Reduction (tons/day)
Land preparation	35.2	9.2
Harvest	35.6	13.2
Other	49.6	8.4
Unpaved roads	11.5	2.4
Unpaved equipment and traffic areas	7.4	0.9
Corral/manure handling	1.4	0.1
Overall management/feeding	1.5	0.03
Pens/manure handling	0.9	0.01
TOTAL	143.1	34.2

Note: The emissions and emissions reduction for Unpaved Roads and Unpaved Equipment and Traffic areas include those from dairies and feedlot operations.

Rule 4550 is expected to apply to most aspects of farming operations and AFOs. However, PM10 emission factors for poultry operations are not available and not included in the 1999 base emission inventory. Therefore, District staff preliminarily evaluated the potential emissions and emissions reduction. Due to the type of housing used for poultry operations, the PM10 emissions are expected to be relatively small compared to other sources.

3. COST EFFECTIVENESS ANALYSIS

The cost effectiveness of a control option is the added annual cost (in dollars/year) of the control technology or technique, divided by the emissions reduction achieved (in tons/year). Cost effectiveness is expressed in dollars per ton of pollutant reduced ($/ton). The cost can include capital equipment costs, engineering design costs, additional labor and maintenance costs. The cost effectiveness also accounts for any monetary savings realized by the implementation of the control technology or technique.

The cost effectiveness of implementing CMPs depends largely on the current farming/operation system. Growers/operators may implement certain CMPs more easily than others for many different reasons and may also choose to implement certain CMPs that can cost more but can result in a savings in the future years. However, it is

expected that there may be occasions where a CMP could not be selected or implemented for certain reasons. For example, if a CMP could not be selected from one CMP category due to infeasibility, the rule allows the selection of two CMPs in one CMP category to substitute for the other CMP category where no CMP could be selected. Therefore, there are many possibilities for selecting CMPs.

Two scenarios were analyzed for cost effectiveness, a low cost scenario and a high cost scenario. The low cost scenario assumes that most growers/operators will comply with the rule by implementing practices with the lowest cost or cost savings. The high cost scenario assumes that growers/operators will comply with the rule through the use of CMPs that are more costly.

The cost effectiveness analysis demonstrates a savings when reducing the number of passes for the Land Preparation CMP Category. It also shows some potential savings in the Harvest CMP Category. For the other CMP categories, the analysis generally shows a net cost.

The cost effectiveness for the low cost scenario is approximately $8 per ton of PM10 reduced per year. For the high cost scenario, the cost effectiveness is approximately $2,500 per ton of PM reduced per year.

A. Assumptions Used in Calculating Cost Effectiveness

In calculating the cost effectiveness District staff assumed the following:

1. One significant assumption that was used in conducting the cost effectiveness analysis for the rule was that the cost effectiveness analysis will reasonably estimate, for the program, cost effectiveness for all the sources subject to the proposed requirements of Rule 4550 with an 80% compliance rate.

2. The annual costs of CMPs per SIC are based on the proposed requirements as contained in the versions of draft Rule 4550 and draft Rule 3190 dated November 24, 2003.

3. For purposes of distributing capital costs of CMPs on a per acre or per head basis, it was assumed that an average agricultural site is 700 acres in size for cropland; 800 dairy cattle, 5,000 feedlot cattle, and 365,000 chickens for AFOs.

4. It was assumed that the average agricultural site has approximately 1 acre of unpaved roads and 1 acre of unpaved traffic area.

5. The estimated emission reductions are reasonably representative of what is achievable for each cost scenario.

6. It was assumed that the proposed requirements of Rule 4550 would require only incremental changes in farming operations that would eliminate passes and prevent fugitive dust emissions where applicable. Some changes will result in savings due to improved efficiency. This will depend on the individual farming system and the ability of the grower/operator to implement the practice.

7. For the low cost scenario, it was also assumed that growers/operators would most likely select CMPs that have no or minimal cost, or CMPs already implemented to meet the requirements of Rule 4550.

8. For the high cost scenario, it was also assumed that growers/operators may choose to invest in a CMP that would have a high cost associated with it primarily to reduce labor cost, increase yield, or reduce mites infection as a primary purpose and secondarily to reduce air quality impacts.

9. The CMPs cost/savings were adjusted to only reflect the cost/savings attributable to Rule 4550.

B. Sources of Cost Data

Rule 4550 will apply to agricultural operation sites used to grow or raise a wide variety of crops and animals. Due to this, District staff used many different sources in collecting cost data. Some of the cost information sources included UC Davis and ARB (various documents), Draft Regulation VIII Staff Report dated September 2001, the 2003 PM10 Plan, inputs from UC Davis Cooperative Extension, inputs from stakeholders, and NRCS/RCD, and internet research.

The data used are the best estimates that could be found to show a range of cost for the affected sources for each SIC and would not reflect the actual cost on an individual basis.

C. Cost Effectiveness Calculation

Cost effectiveness is the total annualized cost, in dollars, of the potential CMPs divided by emissions reduction potential, in tons, of the potential CMPs. Cost effectiveness is

expressed in dollars per ton of pollutant reduced ($/ton). Cost effectiveness was calculated for the SICs shown in Table 4.

Table 4: Annual Cost of CMPs per SIC

SIC	SIC names	CMP cost ($/year)	
		Low cost scenario	High cost scenario
SIC 011	Cash grains	(49,000)	3,813,000
SIC 013	Field crops, except cash grains)	(42,000)	7,260,000
SIC 016	Vegetables and melons	(247,000)	1,536,000
SIC 017	Fruits and tree nuts	(235,000)	8,348,000
SIC 021	Livestock, except dairy and poultry	20,000	890,000
SIC 024	Dairy Farms	449,000	8,733,000
SIC 025	Poultry and egg	56 (fifty six)	276,000
Total cost	--	(104,000)	30,856,000

(A parentheses indicates a savings)

District staff calculated the cost effectiveness as

Cost Effectiveness = Annual Cost of CMPs / Emissions Reduction

Low cost scenario:
($8)/ton of PM10 reduced/ year = ($104,000/year) / (34.2 tons/day x 365 days)

High cost scenario:
$2,500/ton of PM10 reduced/year = ($30,856,000 /year) / (34.2 tons/day x 365 days)

4. RESULTS

A. Emissions Reduction

The emissions reduction analysis arrived at an estimated PM10 emissions reduction of 34.2 tons per day.

B. Cost Effectiveness

The preliminary cost effectiveness analysis presents a range of $8 savings to $2,500 per ton of PM10 reduced per year. Even for the high cost scenario, the estimated cost effectiveness is considered to be reasonable.